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WORLD INTELLECTUAL PROPERTY ORGANIZATION
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
F04B 27/10, 27/18

A2

(11) International Publication Number: WO 00/53927

(43) International Publication Date: 14 September 2000 (14.09.00)

(21) International Application Number: PCT/BE99/00033

(22) International Filing Date: 9 March 1999 (09.03.99)

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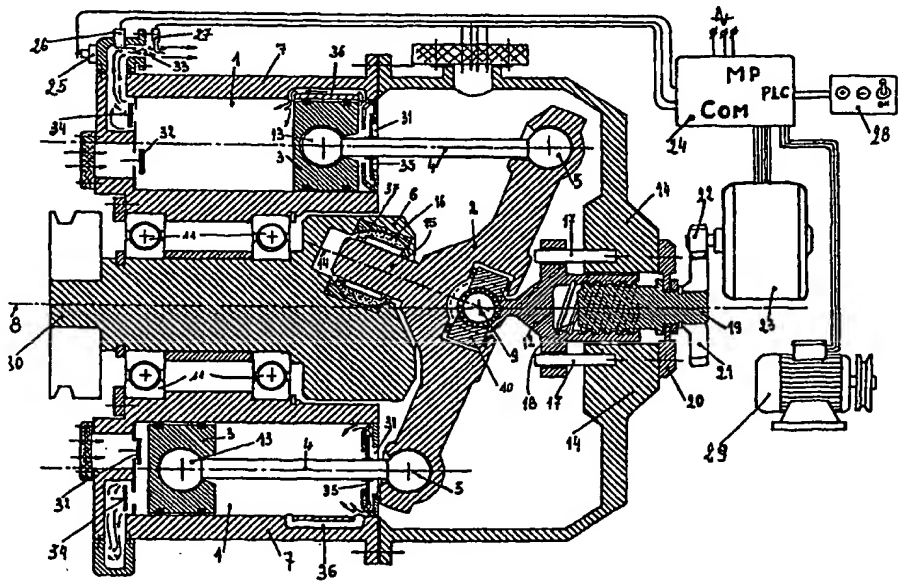
(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

Without international search report and to be republished upon receipt of that report.

(54) Title: PISTON COMPRESSOR



(57) Abstract

The present invention relates to a piston compressor comprising (a) at least one fixed cylinder (1) which is positioned essentially parallel with respect to a central axle (8), in which cylinder (1) a piston (3) is moveably mounted; (b) a tumble disc (2) with a centre (9) which is located on the central axle (9), which tumble disc (2) is tiltably mounted in all directions; and c) with respect to the central axle (8), axial, ball beared component (6) which is rotatably mounted and excentrically coupled to the tumble disc (2).

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Piston compressor.

The present invention relates to a novel piston compressor.

The piston compressor of this invention presents the advantage that notwithstanding the presence of a large number of cylinders as compared to the conventional piston compressors, its weight and volume can be significantly reduced. With the present invention, the volume and weight of the piston compressor can be reduced with at least 75%. The piston compressor of this invention presents the additional advantage that it operates almost noise and vibration free.

Because the piston rods execute a displacement which is mainly rectilinear, almost no lateral pressure is exerted to the pistons, thus reducing friction losses and wearing so that almost no friction losses occur.

With the piston compressor of the present invention, the compression and flow rate can be adjusted, either individually or simultaneously, either manually, electronically, electrically or computer controlled, without necessitating the use of additional pressure relief valves or the like.

The piston compressor of this invention comprises (a) at least one fixed cylinder which is positioned essentially parallel with respect to a central axle, in which cylinder a piston is moveably mounted; (b) a tumble disc with a centre which is located on the central axle, which tumble disc is tiltably mounted in all directions; and a with respect to the central axle 8, axial, ball beared component 6 which is rotatably mounted and excentrically coupled to the tumble disc.

The tumble disc can be moved along the direction of the axle through a worm drive. Depending on the direction in which the tumble disc is displaced, the tumble disc is capable of increasing or decreasing the cylinder volume and controlling the length of stroke of the piston, thus adjusting the compression and flow rate.

The displacement mechanism of the tumble disc comprises a piston which is moveable in a cylinder. One end of the piston is hingedly connected to the piston rod, the other of the piston is hingedly connected to the tumble disc. The displacement mechanism of the tumble disc further comprises an axial ball beared rotatable component which is excentrically connected to the tumble disc.

The invention is further elucidated in the attached figures and description of the figures without being limited thereto.

In figure 1, a cross section of a preferred embodiment of the piston compressor of the present invention is shown.

In figure 2, a circular positioning of the cylinders within the piston rod is shown.

The piston compressor shown in figure 1 comprises at least one, preferably eight cylinders 1 mounted along a circle. The cylinders 1 are preferably mounted in a common cylinder block 7 and mounted along a circle which extends around the central axle 8 of the cylinder block 7.

The embodiment of the piston compressor shown in figure 2 comprises a tumble disc 2 which is rotatable in all directions, under a fixed angle. Each cylinder 1 comprises a piston 3 which is moveable within the cylinder 1. Each piston is connected at one end to the hingedly mounted piston rods through a hingeable ball 13, and at the other end to the tumble disc 2. The piston compressor further comprises a rotatable part 6. The tumble disc 2 is excentrically coupled to the rotatable

part 6. The tumble disc 2 comprises a centre 9. The tumble disc 2 is mounted under a fixed angle with respect to the central axle 8 and is tiltably mounted around its centre 9 on the axle 8. In order to allow a smooth displacement centre 9 is connected through a cardan joint 10 or an equivalent joint.

The rotatable part 6 is axially placed with respect to the central axle 8 and ball beared. The rotatable part 6 and the tumble disc are preferably coupled to each other through meshing parts which are rotatable and moveable with respect to each other along the central normal 14 of the tumble disc 2. Thereto, the tumble disc comprises a protruding axle part 15 that extends along the central normal 14 and fits into a seating 16 in the rounded tip of the rotatable part 6.

The cardan joint 10 or its equivalent, is supported by a support 12 which is slideable within the support block 7. The sliding axes 17 which are fixed to the supporting block 7 allow that the supporting part 12 can be rotated around the central axle 8.

The supporting part 12 has an internal thread 18, which is trapezoid in the embodiment shown in figure 2, but which can be made in all kinds of worm like threads. The worm spindle 19 is fixed by a cover plate 20. At the end of the worm spindle 19, for example a gear wheel 21 can be mounted, which may be driven by a second gear wheel 22 mounted on the axle of a servo motor 23. Gear wheel 21 can be a worm wheel, in which case the gear wheel 22 is replaced by a worm spindle attached to a servo motor 23 or step motor. In stead of a gear wheel 22, use can be made of a handle, so that the worm spindle 19 can be manually, externally rotated.

The servo motor 23 is preferably controlled by a programmed computer, microprocessor or P.L.C. 24, which receives its data from a t mperature registration device 25, pressure gauge 26 and a flow meter 27. The servo motor 23 can also be controlled by a control

panel 28. The driving motor for driving the computer also receives data from the computer, microprocessor or P.L.C 24.

The manner in which the compressor functions can be derived from figure 1. In case the axle 30 is driven by the drive motor 29, the protruding axle part 15 will be execute a circular displacement, as a consequence of which the tumble disc 2 will be tilted and the piston executes a reciprocating movement, going up and down. The piston compressor comprises the required inlets 31, inlet valves 32, outlets 33 and outlet valves 34, so as to obtain the compression effect.

According to a preferred embodiment of figure 1, the chambers of the cylinders are filled almost twice. When the piston 3 is moved to the upper dead point, the lower part of the chamber below the piston can be filled through the opening 31. During the downward movement of the piston, an under pressure is created above the piston 3, as a consequence of which valve 32 is opened and the cylinder is filled with gas or air. Thereby, a pressure is created below piston 3 until the piston 3 has reached its lowest dead centre point. At that point, the inlet of channel 36 is opened, so that the compressed gas (for example air) is freed in the cylinder, as a consequence of which this cylinder 1 contains almost the double volume of gas, at only a half stroke. This results in a higher yield of the piston compressor.

In the piston compressor of this invention, the adjustment of the centre 9 of the tumble disc is rather special. By rotating the worm spindle 19, the support 12 is moved forward or backward, depending on the direction in which the worm spindle 19 is rotated. Thereby the volume of the cylinder chamber is increased or decreased. In that way the pressure and flow rate can be adjusted according to the data that have been programmed in the computer, microprocessor of PLC 24, which then start a servo motor 23 for determining the correct position of the support point 9.

When the support 12 is pulled back by the worm spindle 19, which worm spindle 19 is rotated by the servo motor 23, the angle of the axis as varied and the length of the stroke is varied. This is possible through a self aligning bearing 16. In that way the energy consumption can be reduced to a minimum when a low pressure and/or flow rate are required.

The present invention is not limited to the example and drawings described above.

CLAIMS.

1. A piston compressor characterised in that it comprises (a) at least one fixed cylinder (1) which is positioned essentially parallel with respect to a central axle (8), in which cylinder (1) a piston (3) is moveably mounted; (b) a tumble disc (2) with a centre (9) which is located on the central axle (9), which tumble disc (2) is tiltably mounted in all directions; and a with respect to the central axle (8), axial, ball beared component (6) which is rotatably mounted and excentrically coupled to the tumble disc (2).

2. A piston compressor as claimed in claim 1, characterised in that centre (9) of the tumble disc (2) is hingedly mounted within said piston compressor.

3. A piston compressor as claimed in claim 1 or 2, characterised in that the tumble disc (2) is hingedly attached by means of a cardan joint (10).

4. A piston compressor as claimed in any one of claims 1 to 3, characterised in that the piston (3) comprises a piston rod (4), which is hingedly connected to the piston (3) and the tumble disc (2) through a ball joint (5, 13).

5. A piston compressor as claimed in any one of claims 1 to 4, characterised in that the piston (3) comprises a piston rod (4) which is hingedly mounted in the pistons (3) through ball joints (13).

6. A piston compressor as claimed in any one of claims 1 to 5, characterised in that the rotatable part (6) and the tumble disc (2) are coupled to each other through meshing parts which are rotatable and moveable with respect to each other along a normal through the central normal (14) of the tumble disc (2).

7. A piston compressor as claimed in claim 6, characterised in that the meshing parts comprise an axle part (15) of the tumble disc (2), which axle part (15) extends parallel to the normal (14)

and is provided on the tumble disc (2), and a seal for this axle part, which is applied in the rotatable component (6) under an angle.

8. A piston compressor as claimed in claim 7, characterised in that the axle part (15) of the tumble disc (2) is mounted in the bearing (16) of the rotatable component (6) through a ball joint (37).

9. A piston compressor as claimed in any one of claims 1 to 8, characterised in that it comprises a control mechanism comprising a worm shaft (19) and a support (12) positioned by a cover plate (20), whereby the tumble disc (2) is movably mounted at its centre point (9) along the central axle (8), wherein the piston rods (4) are connected to the tumble disc (2) and are moveable together with the tumble disc (2) and the pistons (3) are connected to the piston rods (4) and are moveable together with the piston rods (4).

10. A piston compressor as claimed in claim 6, characterised in that it comprises a built in control mechanism which is driven by a servo motor (23), through gear wheels (21) and (22).

11. A piston compressor as claimed in claim 9 or 10, characterised in that the control mechanism is provided with means for either manually, electrically by means of a switchboard, electronically by a programmed computer, a microprocessor or P.L.C. (24), controlling the control mechanism.

12. A piston compressor as claimed in characterised in that it comprises a drive motor (29), the rotational speed of which can be controlled by means of a switch board, a programmed computer, a microprocessor or P.L.C. (24).

13. A piston compressor as claimed in claim 11 or 12, characterised in that the programmed computer, microprocessor or P.L.C. (24) are controlled by a temperature sensor (25), a pressure sensor (26) or a flow rate sensor (27).

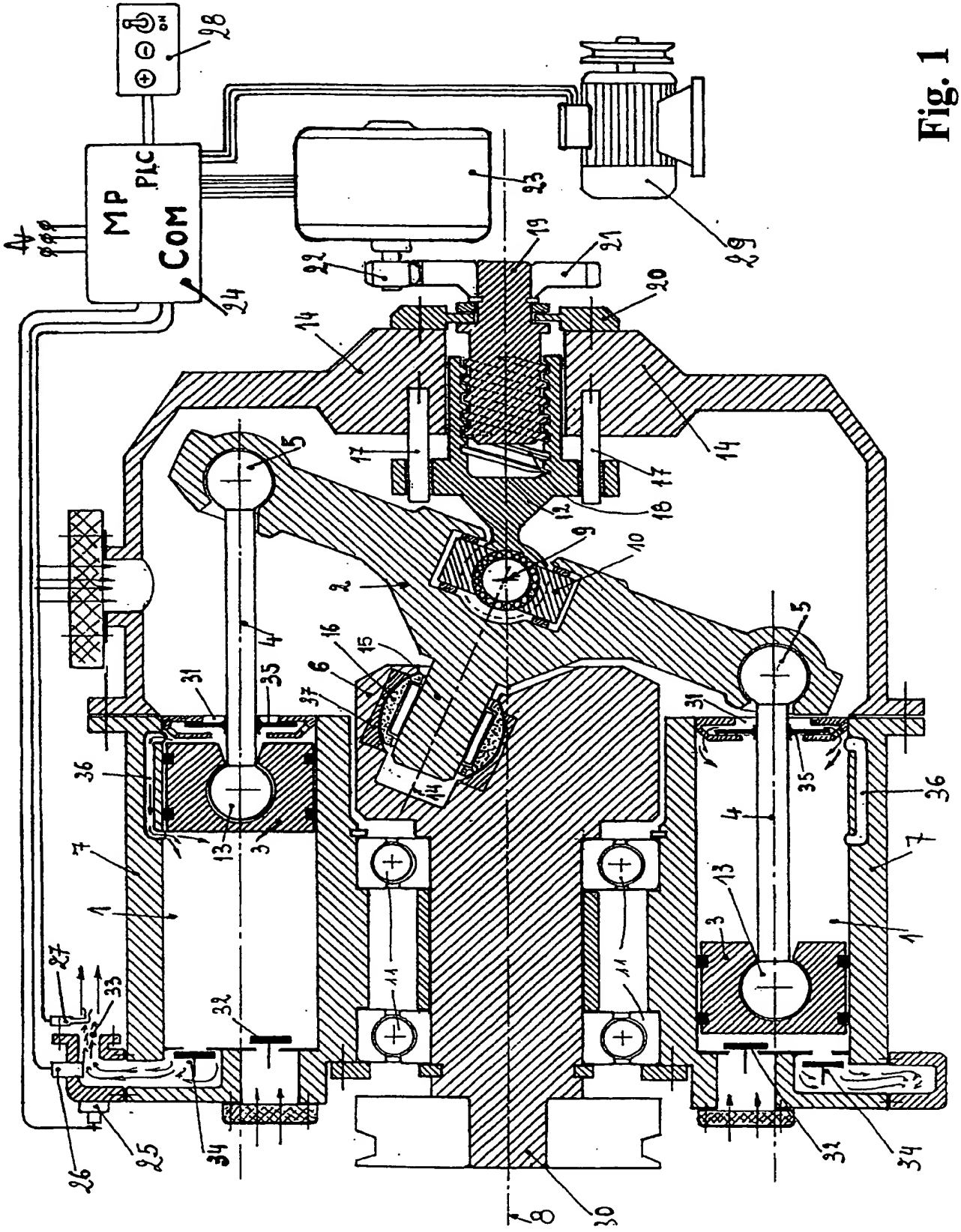
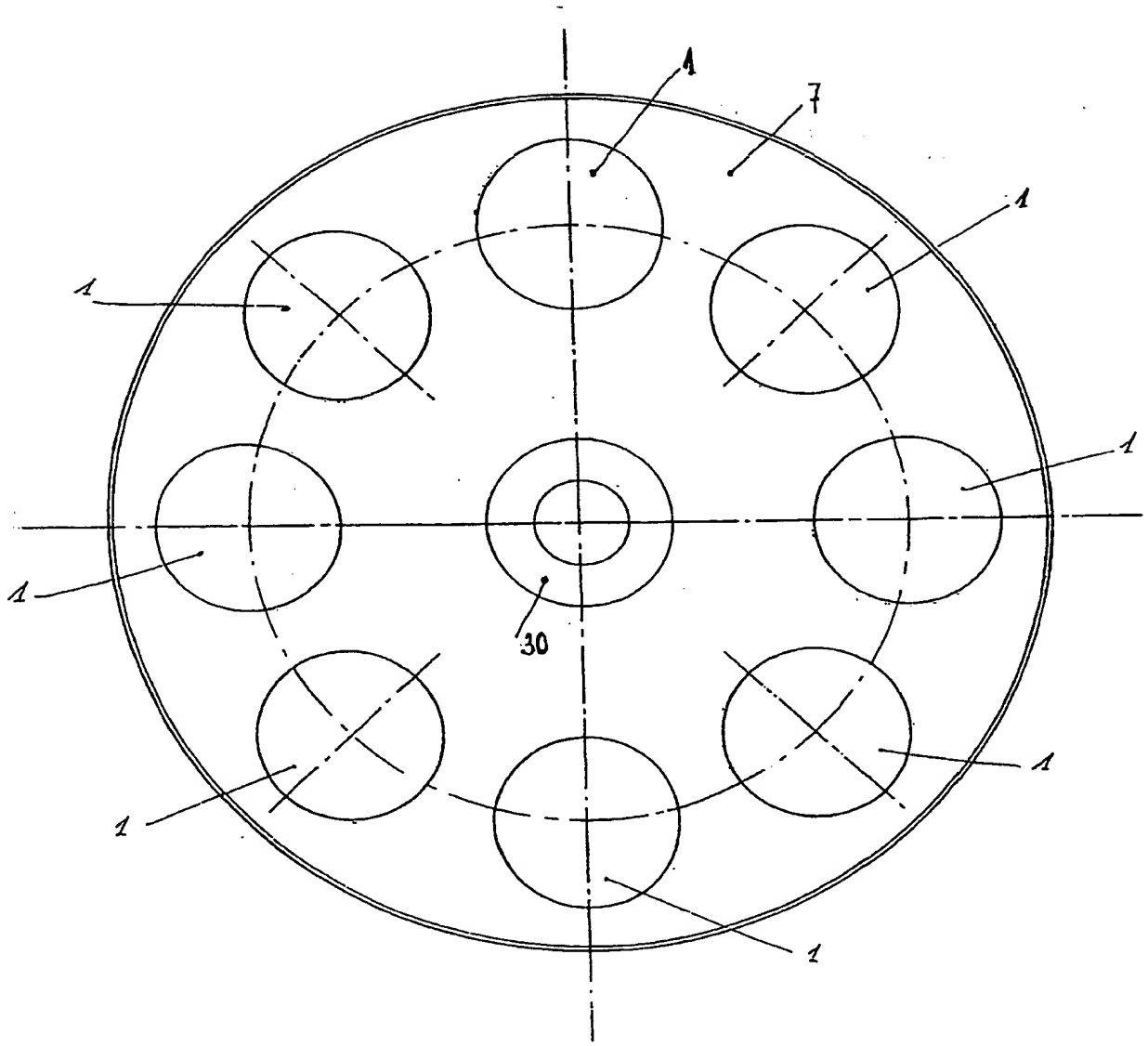


Fig. 1

Fig. 2



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 September 2000 (14.09.2000)

PCT

(10) International Publication Number
WO 00/53927 A3

(51) International Patent Classification[7]: F04B 27/10, 27/18

(21) International Application Number: PCT/BE99/00033

(22) International Filing Date: 9 March 1999 (09.03.1999)

(25) Filing Language: English

(26) Publication Language: English

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(81) Designated States *(national)*: AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW.

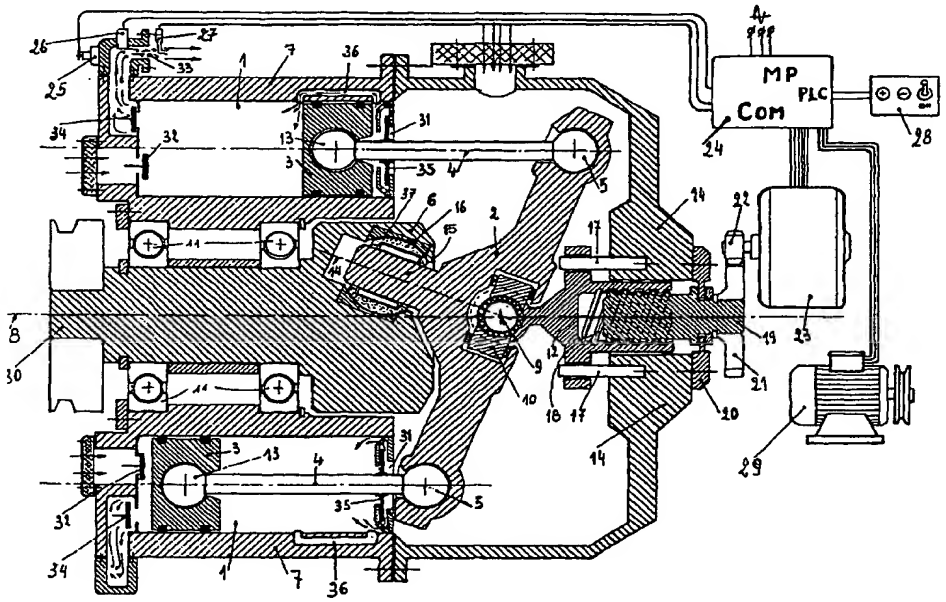
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report:
2 May 2002

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PISTON COMPRESSOR



(57) Abstract: The present invention relates to a piston compressor comprising (a) at least one fixed cylinder (1) which is positioned essentially parallel with respect to a central axle (8), in which cylinder (1) a piston (3) is moveably mounted; (b) a tumble disc (2) with a centre (9) which is located on the central axle (9), which tumble disc (2) is tiltably mounted in all directions; and c) with respect to the central axle (8), axial, ball beared component (6) which is rotatably mounted and excentrically coupled to the tumble disc (2).

WO 00/53927 A3

International Appl[illegible]
PCT/BE 99/00033

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F04B27/10 F04B27/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F04B F01B

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	PATENT ABSTRACTS OF JAPAN vol. 007, no. 291 (M-265), 27 December 1983 (1983-12-27) & JP 58 162780 A (TOYODA JIDO SHOKKI SEISAKUSHO KK;OTHERS: 01), 27 September 1983 (1983-09-27) abstract	1,2,4-6, 9-13
A	US 2 457 339 A (BERTEA) 28 December 1948 (1948-12-28) figures 1,2 column 2, line 35 -column 3, line 52	1,2,6,9

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Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2 570 698 A (MANSEAU) 9 October 1951 (1951-10-09) figure 1 column 1, line 1 - line 35	1,2,6,9
A	EP 0 081 205 A (LEHMANN DIETER) 15 June 1983 (1983-06-15) figure 1 abstract	1,2,6,9

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